

# Ontario encourages source separation

A six-point Ontario Government policy to support, encourage and expand source separation and recovery of domestic waste was announced by Environment Minister Harry C. Parrott at the annual conference of the Association of Municipalities of Ontario.

There are several options in the management of mountains of solid waste collected daily in Ontario municipalities, Dr. Parrott said. Of these, the most common disposal method, landfilling, "is just plain dumb."

It is a waste of limited resources and we are fast running out of public acceptance for holes in the ground for waste disposal, he said.

There are other options available: waste can be burned directly

for energy or it can be separated and processed in large and costly plants. Or it can be separated at the source in individual homes, Dr. Parrott said.

"On the first two solutions, work is already under way through the Ministry of Energy and our experimental resource recovery facility in Downsview," Dr. Parrott said. "The third option that of source separation and recovery is the one I personally prefer as our highest priority."

Several projects aimed at the recovery of useful material from waste already exist in Burlington, Richmond Hill, Hamilton-Toronto, East York, the City of Toronto, Etobicoke, Aurora, Georgetown and other municipalities.

But much more can be done. To help the introduction of source separation programs in many more Ontario municipalities, the Ontario Government will:

1. Encourage a significant increase in demand for recovered materials. Financial assistance to industry has already spurred the development of de-inking plants and contributed substantially to the opening of a large new market for waste newspaper in Ontario.

2. Initiate and fund research and demonstration of alternative systems for source separation to improve their cost effectiveness. Agreement has been already reached and funds have been committed for a pilot project in the

Region of Halton, in which materials will be recovered by source separation in homes, offices, commercial and industrial operations.

3. Environment Ontario wants to encourage municipalities to exercise control over solid waste to ensure that every opportunity for multi-material source separation is being used. The province's Waste Management Advisory Board has developed a manual which will show municipalities how to set up a regional source separation project.

4. Provide financial incentives or other assistance to municipalities or private companies and volunteer organizations to encourage implementation, ex-

tension or continuation of source separation schemes. One type of assistance consists of the development of promotional material for the community.

5. The ministry will monitor the quantity of materials recovered, current market prices, cost of recovery and the supply and demand situation for recyclable materials to help municipalities to adjust to changes.

6. Environment Ontario will also encourage, province-wide and locally, a balance between the use of materials and energy saved through source separation and waste processing, to prevent conflicts between these options.

## Grants of \$82.6 million for municipal projects

Over 200 Ontario municipalities are eligible to receive \$82.6 million in federal grants for environmental sewage and water system improvements carried out during 1979 and 1980 under the Community Services Contribution Program.

Paul Cosgrove, federal minister responsible for Canada Mortgage and Housing Corporation and Harry C. Parrott, Ontario Environment Minister made the joint announcement and said that these funds are in addition to the \$54.95 million available to Ontario, under the same program, for Neighborhood Improvement and Municipal Non-Profit Housing Projects administered by the Ontario Ministry of Housing.

Grants for the first year of the program, for some 265 projects in 106 Ontario municipalities, total \$31 million, payable in fiscal year 1980-81. They are provided by the federal government and administered by the Ontario Ministry of the Environment, under the Municipal

Infrastructure portion of the Community Services Contribution Program, replacing grants formerly made directly by CMHC.

"Co-ordination of federal grants with those of the province makes the program more flexible and more readily adaptable to changing municipal and provincial priorities," said Mr. Cosgrove.

Dr. Parrott added that results last year proved that the new grant program worked well and met the needs of municipalities more closely. "Co-ordinating the Community Services Contribution Program grants with funds provided by the Province streamlines the entire process and we are very pleased with the results to date."

Major projects covered by the grants included: \$1.0 million towards construction of the Duffin Creek Sewage Treatment Plant (STP) which is part of the York-Durham system; \$1 million for STP at Hanover; \$1.1 million for STP at Killaloe; \$1 million for STP at Port Colborne; \$0.5 million for a water treatment plant at Burlington. Other Ontario communities will be receiving grants for projects which include water intakes, treatment and storage facilities, trunk sewers along with sewage treatment facilities, sanitary sewers, pumping stations and trunk storm sewers.

It is estimated that in the second year of the Community Services Contribution Program over \$51 million, payable in fiscal 1981-82, will be available to support over 300 projects that will be under way in 1980 in about 160 municipalities.

### BANKS PROMISE FUNDS

Nine international development agencies and banks have signed an environment policy declaration in New York that would provide funds for environmental projects in Third World programs.

The declaration of intent provides funding for the education of staff for the inclusion of environmental protection measures into developing country projects. It also promises to "actively consider" funding of projects not only for the protection but also for a rehabilitation of the environment.

## ENVIRONMENT ONTARIO **LEGACY**

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## First overseas students join Environment Ontario STP course

Seven sewage and water treatment operators from Ghana and one from Tanzania were the first overseas students to attend the unique basic gas chlorination course offered at Environment Ontario's training facility in Brampton.

The African students are municipal employees involved in water and sewage treatment in their homelands. They chose the Brampton facility to widen their experience as it is the only one offering training in on-line equipment under operating conditions.

Since the conversion of the old Brampton sewage treatment plant to a training facility in 1976, up to 1,500 provincial, municipal and private employees involved in water and sewage treatment or noise abatement have attended the about 40 courses offered each year.

Traditionally, most of the students are Ontario residents interested in the upgrading or widening of their skills. Others come from the other Canadian provinces, from American states or from the Caribbean.

The curriculum offered by Environment Ontario instructors includes basic and advanced sewage and water treatment plant operation and maintenance, gas chlorination, industrial air abatement, acoustics technology, MOE inspections and other related courses. Tuition is available to all provincial, municipal or private pollution abatement employees at a nominal fee.

The Ghana students Tarfa Fusseini, Oscar Amanfo and Samuel Anthony (all standing) observe fellow student Godfrid Ofasu and Eric Lyle use a repair kit on a one-ton chlorine container.

(photo: R. Koci)

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**It's all one world...**

## Minimata disease not found in Canada



Environment Ontario's fish eating recommendations ensure that he will be able to enjoy the supper he caught. (photo: Ron Johnson)

There is little, if any danger of finding cases of Minimata disease in Canada, concludes a report "Methylmercury in Canada," written by Dr. Brian Wheatley, director of the federal Department of Health and Welfare's medical services branch.

Dr. Wheatley's conclusion is based on 35,683 blood and hair tests for mercury levels carried out in 350 Indian and Inuit communities in Canada between 1971 and 1978. Over 95 percent of these tests were made in 1975 to 1978.

"At risk" levels of over 100 parts per billion of mercury in the blood of individuals were found in residents of 43 communities and constituted 2.5 percent of the total results.

These levels were found mainly in Quebec, Ontario and the Northwest Territories. The highest level found was 660 ppb in a resident of Whitedog, Ont., in 1971.

A total of 546 individuals had peak blood mercury levels of over 100 ppb at least once during the tests period. Of these, 402 were from Quebec and 105 from Ontario. A content of 100 ppb of mercury in blood is considered to be an "at risk" level, although the World Health Organization has established that even the most sensitive 5 percent of individuals fail to show symptoms of methylmercury poisoning at levels of 200 to 500 ppb.

"The results of individual clinical examinations have been inconclusive," writes Dr. Wheatley. Of 84 "at risk" individuals examined, 73 had no abnormalities and 11 had uncertain findings. During the years in which testing was done no death could be attributed to methylmercury poisoning, and no definite incidence of the disease could be established.

The report suspects higher levels of mercury could be found in individuals at certain times of the year. Indian consumption of mercury-contaminated fish is seasonal, but between seasons there is room for a "drying out" period.

The human body naturally eliminates about half of its mercury content in about 70 days. Whether this elimination period also applies to the brain is as yet uncertain, the report states.

The report suggests that the risk of methylmercury poisoning can be alleviated by the replacement of the consumption of fish by other products. But it is particularly important that pregnant women be warned about contaminated fish consumption and be given alternatives. There are indications that the eating of mercury-contaminated fish may cause brain damage to the fetus during the last three months of pregnancy.

## Chromosome damage questioned

The study that indicated that residents of the Love Canal area in Niagara Falls, N.Y., had suffered chromosome damage has virtually no value and can not be salvaged, concluded a panel of experts convened by the U.S. Environmental Protection Agency.

Another panel of experts called by the U.S. Department of Health and Human Services came to very similar conclusions after a review of the same study conducted by the Biogenics Corporation of Houston led by Dante Picciano on contract to the EPA. The HHS panel members agreed that the most glaring deficiency of the study was its lack of simultaneous controls, and that therefore the results have

caused a panic among the inhabitants of the Love Canal area, are meaningless.

The EPA panel concluded that there was no evidence of excessive chromosome deficiency in Love

Canal area residents and that the "supernumerary acentric chromosomes," designated in the original study as the damaged ones, "existed only in Picciano's mind."

## Greenhouse effect is real

The enrichment of the atmosphere with CO<sub>2</sub> does indeed have a warming effect, indicate preliminary results of an Australian research team, reports the British magazine *New Scientist*.

Mathematician models have predicted that the doubling of the carbon dioxide levels in the atmosphere expected during the next 100 years should warm the earth's surface by about 3°C. Such a rate of increase in temperature should have a detectable influence on rainfall in some parts of Australia.

By analyzing meteorological reports, Dr. Brian Tucker from the Atmospheric Physics Division of the Commonwealth Scientific and Industrial Research Organization, actually found data confirming the prediction of the mathematical model.

world's wealthiest 23 countries is improving, reports the Organization for Economic Co-operation and Development from Paris.

Research on pollution control has expanded knowledge on pollutants and their effects on mankind and ecosystems. This has created new concerns, especially about the long-term effects of chemicals.

Another pollutant of immediate concern is noise. More than 100 million people or about 15 or 20 percent of the inhabitants of developed countries are exposed daily to outdoor noise levels of more than 65 decibels, an amount that may cause damage in the long run.

## Recycling pays

A New England supermarket chain, Stop & Shop, realized \$614,000 from the sale of used cardboard containers for recycling in 1979. This amount covered about half the cost of the chain's waste management program.

### Waters improve

Gross pollution, such as the dumping of raw sewage into rivers and lakes, is being controlled and the quality of rivers and lakes in the



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of the  
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## Radioactive waste can be reduced

"I think one could remove all the radioactivity from a large mill with a gadget the size of a washing machine... and put it in one steel drum that could be safely stored under the ground," says C.J. Bland, a University of Calgary physicist.

In extracting uranium from its ore, a slurry of rock and water is left over — the water containing dissolved highly radioactive radium. This wastewater is currently collected in ponds and treated with chemicals which cause a white powder to settle. A large mine can generate several tons of this radioactive material in a month.

Acres of radioactive tailings can be found in fenced-off areas around the country. Not only is the land unusable, says Bland, but there is danger of the powder blowing about or being leached by rainwater.

Bland has developed filters that could shrink the giant problem to teaspoon dimensions.

The filters consist of cellulose or acrylic fibres coated with oxidized manganese which has a strong affinity for radium. Up to 95 percent

of the radioactivity from mill wastewaters has been removed by these filters in tests at Elliot Lake, Ontario, and Beaverlodge, Alberta, says Bland. When the filters become saturated they can be burned, leaving a small quantity of radioactive ash, or they can be treated chemically to extract the radioactivity in an even more concentrated form.

### \$10 billion for pollution control

U.S. industry will spend about \$10.5 billion for pollution control equipment in 1980, estimates the economic department of McGraw-Hill Publishing Company. That is 23 percent more than in 1979. About \$1.5 billion of this amount is expected to be spent on solid waste management equipment.

### Waste keeps growing

Until 1990 solid waste generated by U.S. households and industry (except mining and agriculture)

will grow at an annual rate of 2.4 percent, estimates a report recently submitted to the U.S. Environmental Agency by a international research institute. The report also indicates that the share of aluminum and plastics on this increasing stream of waste will increase as these materials are being substituted for steel, wood and glass in consumer goods.

### Oxygen as mutagen

Among the drugs that can cause chromosome breaks and therefore act as mutagens, a report published in the Proceedings of the National Academy of Science for 1952, lists oxygen.

# Huge waste paper market to open

Ontario's largest newspaper recycling program, designed to recover and re-use 100,000 tons of old newspapers per year, is being prepared by the Ontario Paper Company Limited of Thorold.

The project is a direct result of the Ontario Government subsidy program started in 1979 to improve the production and environmental protection equipment of obsolescent plants of the pulp and paper industry.

Ontario Paper has operated a newsprint mill in Thorold since 1913. To remain competitive the plant needed a thorough rejuvenation.

The \$260 million investment needed for reconstruction, however, could be justified only by a 40 per cent increase in production. This could not be achieved by an increase of the supply of raw material from the company's forest limits.

In their search for other sources of raw materials, company experts eventually decided to tap the large and by far not fully used supply of old newspapers that could be collected from households and to reuse it for the production of new newsprint. In the future, they decided, the plant's product would consist of 25 per cent recycled fibre without loss of paper quality.

The company's decision was supported by a \$20 million Ontario Government subsidy. This amount was used to finance the construction of North America's largest deinking plant, a key facility for the paper recycling project.

Thorold is an excellent location for the collection of old newspapers. Within a 250-mile radius of the plant, about 900,000 tons of old newspapers could be available yearly in several metropolitan areas, including Toronto, Hamilton and Buffalo.

In Ontario about 375,000 tons of old paper are discarded yearly. Of this amount, only about 20 per cent

is now being recovered for use in paper mills and for home insulation.

In the U.S. up to 37 per cent of used newsprint is recovered and a recovery of 40 to 50 per cent is considered possible.

To assure the supply of this type of raw material for its rebuilt mill, Ontario Power will start this fall through its subsidiary, Ontario Paper Recycling Incorporated, a large-scale newsprint recovery program. Within this program, the company will:

- Contractually guarantee municipalities or private organizations a firm price for all paper collected.
- Support municipalities or private organizations in any way possible in the collection of old newspapers. This support may range from the establishment of collection systems through company trucks and manpower to the collection of newspaper from local depots or the guaranteed purchase of the amounts collected by private organizations or by municipalities.

The collection program is expected to provide about 60,000 tons of old newsprint by the end of 1981 and 100,000 tons in 1984. In the beginning the company expects to collect about 50 per cent of the raw material in Ontario and 50 per cent in New York State. As the recycling program grows, most of the demand may be met from Ontario alone.

The company's newspaper recycling project will not only provide the raw material for its increased production. It will also provide municipalities or private groups with revenue and will relieve some of the pressure placed on landfilling.

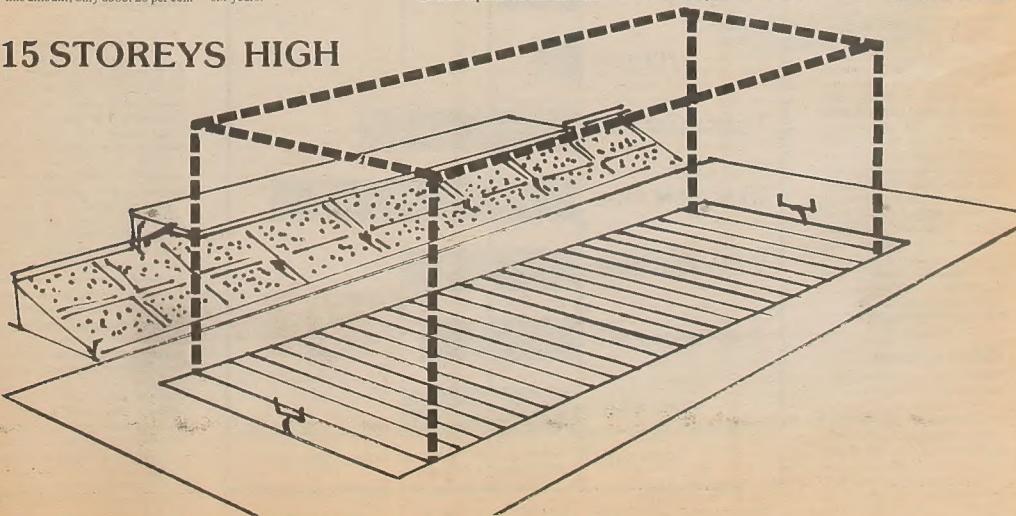
A similar paper recycling project has brought the 170,000 inhabitants of the City of Madison, Wisconsin, a net profit of \$162,000 and a saving of 50,000 cubic yards of landfill space over six years.



Source separation makes collection of used newsprint much easier.

(photo: Is Five Foundation)

## 15 STOREYS HIGH



Ontario Paper's need for used newsprint, 100,000 tons per year, would fill a football field to a height of 15 storeys.

# Phosphorus control pays off in the Great Lakes

\* Adapted from a paper presented by Steve Sabach of the water resources branch and Gordon Van Fleet, of the pollution control branch of Environment Ontario at the Joint Annual Conference APCA and PCAO in Toronto in April 1980.

Eutrophication or natural aging of lakes, from their original oligotrophic through the mesotrophic to their eutrophic states, is reflected in increasing biomass content. This process is largely a result of enrichment of the waters by the three elements phosphorus, nitrogen and silicon.

In many lakes, including the Great Lakes, the most important of the three nutrients is phosphorus. It is also the only one whose input into the waters can be reasonably controlled.

The excessive loading of the Great Lakes with phosphorus derived from human activities has accelerated their natural aging. Only Lakes Superior and Huron are now safely in an oligotrophic state. Lake Michigan is approaching the mesotrophic state, while the lower Great Lakes and Saginaw Bay must be classed as eutrophic, although Lake Ontario and the central and eastern basins of Lake Erie are not yet strongly so.

## phosphorus loadings reduced...

To improve the situation water quality objectives and target phosphorus loadings were established in the 1972 water quality agreement between Canada and the U.S. Since then phosphorus loadings have been reduced by strict limitations on the use of phosphorus in laundry detergents and by the initiation of physical-chemical treatment for the removal of phosphorus in sewage treatment plants.

The following responses to these measures have been observed in the near-shore shallower waters of the affected lakes since:

1. The Bay of Quinte (especially in the inner bay) both phosphorus levels and algal biomass have decreased significantly as a result of phosphorus controls instituted at all major sewage treatment plants by 1977. The most significant finding is contained in the records of the Belleville water treatment plant. Post-phosphorus control densities of algae in samples collected weekly at the raw water intake were between 50 and 60 per cent lower than those recorded prior to 1978.

## water treatment eased...

Most importantly there were clear benefits to water treatment plant operation. The Belleville plant data show much lower turbidity and threshold odour levels than before phosphorus control.

Micro strainers in the treatment plant were in use only for a few weeks during 1978 and 1979 whereas prior to 1978, their use was necessary for four to five months of the year. (See also report 'Crayfish are coming back to Belleville' in the May-June 1980 issue of LEGACY.)

2. In the western basin of Lake Erie the response has been encouraging. Total phosphorus concentrations in the near-shore waters have declined to about 30 ug/l during 1977-1978 from a pre-phosphorus control average of

## Lake Erie improvement encouraging...

40-50 ug/l during 1967-1970. Average annual phytoplankton biomass during the pre-phosphorus control years averaged about 5,000 standard units per ml, decreased steadily between 1971 and 1976 to a low of 2,900 asu/ml but then increased again in 1978. However, the recent increase was attributed almost entirely to the massive mid-summer development of the diatom *fragilaria crotonensis*.

It is not clear why the phytoplankton biomass increased again. The answer may relate to a complex inter-relationship of nutrients, water level changes, water clarity, water depth, temperature and

winds and perhaps other factors. Unquestionably, there has been a net reduction in biomass compared to pre-phosphorus control conditions. However the trend in water quality improvement must now be considered more conservatively than indicated by the first few years of post-phosphorus removal data.

3. In Lake Ontario, four zones between the Niagara River and Oshawa show varying response:

**ZONE 1** — area of high phosphorus levels receiving inputs from Niagara River and the industrial drainage basin of Twelve Mile Creek.

**ZONE 2** — area of relatively low phosphorus levels and moderate population density draining primarily agricultural land.

**ZONE 3** — area of highest phosphorus levels supporting majority of the population and industrial activities situated along the Canadian near-shore of Lake Ontario.

**ZONE 4** — area of low phosphorus levels and relatively low population density.

Highly significant downward trends in phosphorus levels have been documented in all four zones for the 1967-1979 period. The rates of decrease have varied from 3.1 ug/l/year in the Oakville to Toronto zone to 2.3 ug/l/year in the Toronto to Ajax zone, 2.0 ug/l/year in the Niagara to Jordan

Harbour zone and 1.3 ug/l/year in the Jordan Harbour to Oakville zone. The greatest improvement was recorded along the highly developed sector west of Toronto where phosphorus inputs were highest and where, proportionally, the greatest degree of phosphorus reduction occurred.

An interesting pattern exists in lake quality improvement. All data can be divided into two distinct phases. Phase 1, extending from 1967 to 1973, includes the data collected before the establishment of municipal phosphorus controls but after introduction of detergent phosphorus controls. The second phase encompasses data collected from 1976 to 1979 after the implementation of municipal phosphorus control.

The second data set appears to indicate a levelling off effect, but more data are needed to confirm whether the present control programs will lead to some further improvements in water quality.

## ...off to a slow start...

In contrast to the near-shore main lake response to phosphorus controls was not as immediate. Phosphorus levels in the open lake showed little change until 1977 but have subsequently declined as natural mixing and exchange processes extended the effects of con-

trols to the main body of the lake.

While it is clear that phosphorus levels in Lake Ontario have been reduced significantly both in near-shore and open lake, the response of the plankton (algae) to this reduction is more important. If we use the Bay of Quinte and western basin of Lake Erie as a guide we can expect the phytoplankton of Lake Ontario to decline correspondingly, albeit more slowly. Assessment to this aspect will be made by Environment Ontario and Canada in future years.

Additional significant reduction in phosphorus input from major municipal sources in the United States can be expected to further improve water quality particularly in Lake Erie. However, additional reductions will be needed if we are to meet the target loadings contained in the agreement and to achieve the desirable main lake water quality conditions.

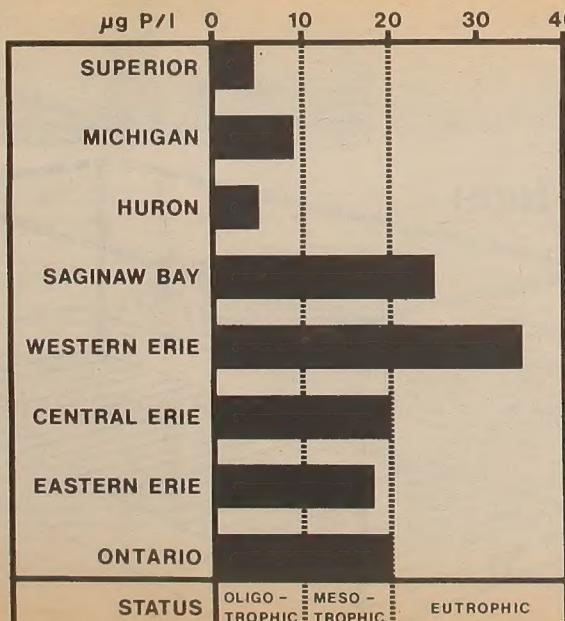
At the same time, it is far from clear what additional phosphorus removal should be instituted. Further reduction of phosphorus will be very complex and costly and it will be very difficult to design a control strategy that can be applied uniformly throughout the Great Lakes.

The complexities of implementing controls on non-point phosphorus, particularly from agricultural crop land, must be addressed. In addition, chemical, biological and land application alternatives for reducing phosphorus discharges to levels below 1.0 mg/l, along with associated costs, must be explored and the question of phosphorus bioavailability resolved if the control programs are to be meaningful. And lastly, the costs of implementing additional controls must be evaluated against benefits which will accrue.

## ...long term strategies...

The recent IJC report makes no recommendations on strategies for achieving the recommended phosphorus loading reductions. However, some immediate actions appear evident and longer-term strategies were previewed at the 1979 IJC annual meeting. These include the complete implementation of the municipal point source control program at municipal plants which have not achieved the 1 mg/l effluent limitation, further point source controls where localized problems occur and a "voluntary approach to remedial action in improving land use practices . . . . .", whereby individuals would be encouraged to adopt better agricultural practices by vigorous public education, technical aid and financial incentive programs."

In the long term, and before commitment to a new major program, it would appear that some very specific information is necessary. Upon completion of a cost-benefit analysis, optimum programs can be developed and implemented to meet recommended loading reductions.



Trophic status of the Great Lakes — spring total phosphorus.

# Hunting for the dangerous asbestos

by Roger Davies

"Chrysotile" and "Amphibole" may sound like names for a herbal brew. They are not. The seemingly innocuous words are part of asbestos terminology, and designate two types of fibre that are known to cause cancer. They have long been pinpointed as a cause of asbestos and other respiratory ailments, especially when they are airborne. The effects of water-borne fibres on human health are still being disputed.

However, sufficient is known to alarm the public and to keep governments busy to reduce the occurrence of this worrisome material. Part of the problem is that asbestos, because of its fire retardant properties, has been widely used in Canada for about a hundred years.

The laboratory services branch of the Ontario Ministry of the Environment knows this only too well. For several years now it has been increasing its sampling efforts, both in response to public concern and in anticipation of future problems.

Unfortunately, one of the largest obstacles to monitoring the presence of asbestos on a grand scale are the limitations of existing analytical techniques.

Analyzing for asbestos is not easy, and it's time-consuming.

## up to three hours search

Typically, examination of one sample can take up to three hours, and considerably longer if you take into account the time needed to prepare the sample," points out Environment Ontario's Dr. Paul Roberts, supervisor of the electron microscope unit, water quality section.

The particles that cause damage are only several micrometres in length. They cannot be seen with the naked eye; only an electron microscope can make them visible.

To establish the presence of asbestos, samples must be taken of water or air. From water sampling bottles, 20 millilitres of water are taken and passed through a filter. The filter consists of a polymer material that has been bombarded with neutrons to produce a great number of small and uniform holes.

In preparation for electron microscopy, the filter is coated with carbon. The carbon forms a smooth surface on the filter and is transparent to the electron beams used in electron microscopy to form the image.

## organic particles are destroyed

A small portion of the coated filter is placed on a circular grid 3 millimetres in diameter. The filter, material is then dissolved away with chloroform, leaving the carbon film supporting the filtered particulate material on the grid.

The procedure used to prepare an air sample for asbestos analysis is slightly more involved. The particulate material in the air under investigation is directly collected on the filter of a 24 hour high-

volume suction-type sampling station. The filter material and organic particles which might otherwise obscure asbestos fibres during the microscopic examination are removed by oxidation in a low temperature oxygen plasma ashing. The remaining material is dispersed in filtered water and a drop is placed on a carbon-coated grid to dry.

## 300 squares for reference

The grid, comparable in size to the size of the head of a finishing nail, consists of about 300 squares which provide the frame of reference for a systematic search for and the counting of asbestos fibres.

To search one grid square at 20,000 times magnification the operator must view about 900 images, each of which shows numerous particles with a wide variety of shapes. The operator cannot view all 300 squares of the grid. He must, however, look 900 times at each one of 20 grid squares to achieve a meaningful result.

The examination of the 20,000 images of just one sample is tiring and hard work. Electron microscope operators work in shifts, generally not more than three hours at the microscope per day.

Just scanning 20 squares of an empty grid (and finding nothing) takes about two hours. The actual squares examined, however, contain a variety of particulates and it takes practice to be able to identify the asbestos fibres.

The technique of electron diffraction is used as an aid in the identification process. The pattern of diffraction spots produced on the viewing screen is unique for each crystalline material.

## diffraction for identification

It also takes experience to tell whether the asbestos particle seen consists of one, two, or more fibres.

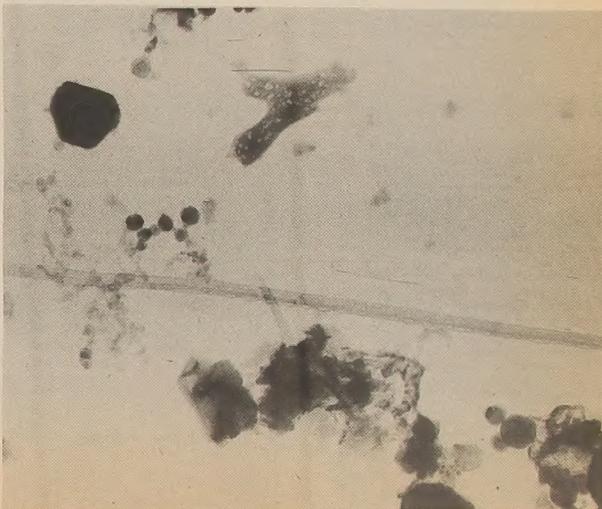
The length and width of each fibre are measured using a series of concentric rings inscribed on the viewing screen.

While scanning, the operator fills out a bench sheet recording pertinent information for each sample — mainly the number, size and type of fibres found in each grid square. The results are then expressed in million fibres per litre for water and fibres per cubic centimetre of air.

"Although these results are based on the scanning of only 20 squares, a relatively small area of the sample, experience shows we can still get consistent and indicative results," points out Dr. Roberts.

"Since the sample is magnified considerably, just finding one fibre translates into a fibre concentration of 0.1 million fibres/litre."

To date, Dr. Robert stresses, in Ontario no air sample from the outside environment has been significantly above the recommended ambient air guidelines of 0.04



Above: A thin strand — that's how an asbestos fibre looks at 40,000 magnification.

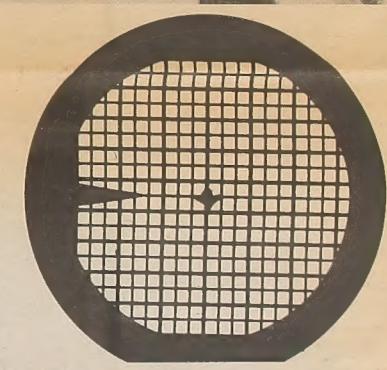
Right: Magnified 20,000 times, each square of the grid becomes about 6 x 6 feet large. As the screen of the electron microscope allows the viewer to scan an area of only about 2 1/4 by 3 3/4 in., the operator must look at 900 images on the screen to view the whole square. Of the 300 squares on the grid, only 20 need to be scanned for each sample — a total of close to 20,000 scans per sample.

## Actual size of the screen grid.

(photo: Environment Ontario)

million fibres/cubic centimetre and no water sample has contained more than 0.8 million fibres/litre.

This is not considered out of line, especially compared with levels of 20, 30, or even two to three hundred million fibres per litre found elsewhere in Canada. It should be pointed out that these



higher levels are associated with asbestos mining areas, where asbestos-caused health problems have historically been severe.

One other limiting factor to asbestos analysis, perhaps not surprisingly, is the cost. The price of an electron microscope today is nearly \$200,000, an amount only a

handful of laboratories in Ontario can afford.

Concern over the consequences of exposure of the general public to asbestos fibres in the air and water of their environment is likely to keep these laboratories busy for several years.

## Coming events

**SEPTEMBER 13-19** — The Sea & Shores of Fundy, Anderson House, St. Andrews, NB — Henrik Kreiberg, director, Sunbury Shores Arts & Nature Centre Inc., St. Andrews, NB EOG 2X0.

**MID-SEPTEMBER** — AWWA, Atlantic Section Annual Conference, Halifax, NS — AWWA, Atlantic section, P.O. Box 608, Halifax, NS B3K 5H4, (902) 426-6901.

**SEPTEMBER 21-22** — Eastern Ontario Municipal Water Association Annual Meeting, Skyline Hotel, Brockville —

James H. Roughley, EOMWA secretary treasurer, Brockville PUC, (613) 342-6661.

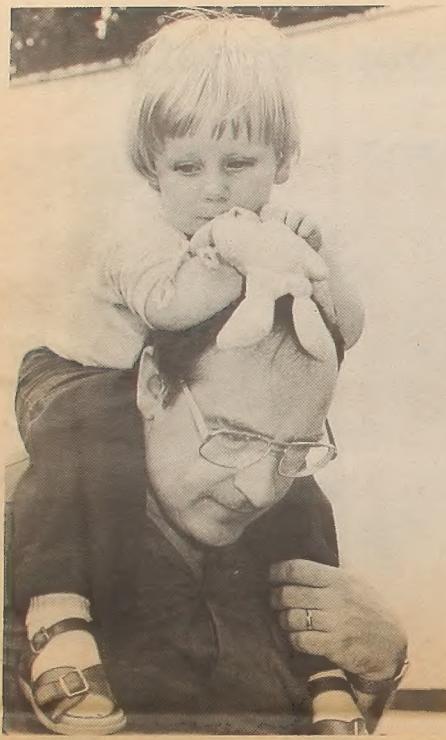
**SEPTEMBER 28-OCTOBER 3** — 53rd Water Pollution Control Federation (WPCF) Annual Conference, Las Vegas, Nevada — Prof. J. Gancarczyk, University of Toronto, Dept. of Civil Engineering, Toronto, (416) 978-3141, or WPCF Headquarters, Washington, DC, (202) 337-2500.

**OCTOBER 29** — Grain Handling, Health Effects and Control Technology, Thunder Bay, (705) 737-4455, or Pollution Control Association of Ontario, (416) 773-4124.

**Ontario** — Air Pollution Control Association, Ontario Section — Wally Vrooman, Environment Ontario, Thunder Bay, (807) 475-1205, or Vic Shantora, Environment Canada, Toronto, (416) 966-5840.

**NOVEMBER 5** — PCAO-MOE seminar on Sewage Sludge Utilization and Disposal in Ontario, Ministry of Health Laboratories, Resources Rd., Toronto — Peter Takosa, (705) 737-4455, or Pollution Control Association of Ontario, (416) 773-4124.

# 2000 attend open house on acid rain



An estimated 2,000 persons found their way to a wooded site near Dorset during the last weekend in July for the biggest open house in the history of the Ministry of the Environment.

They endured frequent showers, a blazing sun and swarms of blackflies to learn more about the environmental phenomenon known as acid rain.

On Paint Lake, a mile west of the village of Dorset, is the Ministry's field laboratory for the study of acid rain and its effects upon the chemistry of lakes and streams.

Sophisticated equipment to collect and analyze the airborne pollutant is housed in a series of connected trailers. The operation is under the direction of Ron Reid.

Visitors were conducted on a walk-through tour of the lab and gathered in clusters outside to view field equipment, charts and graphs, and to question scientists about the probable effects of acid rain in water of the Muskoka and Haliburton areas.

Dorset field staff were complemented by Environment Ontario's staff from Toronto and Gravenhurst and by fish biologists

of the Ministry of Natural Resources.

Ron Reid reported: "We certainly cleared away some of the mystery about the problem. One lady was amazed to find the lemonade she was drinking was much more acidic than any rainfall."

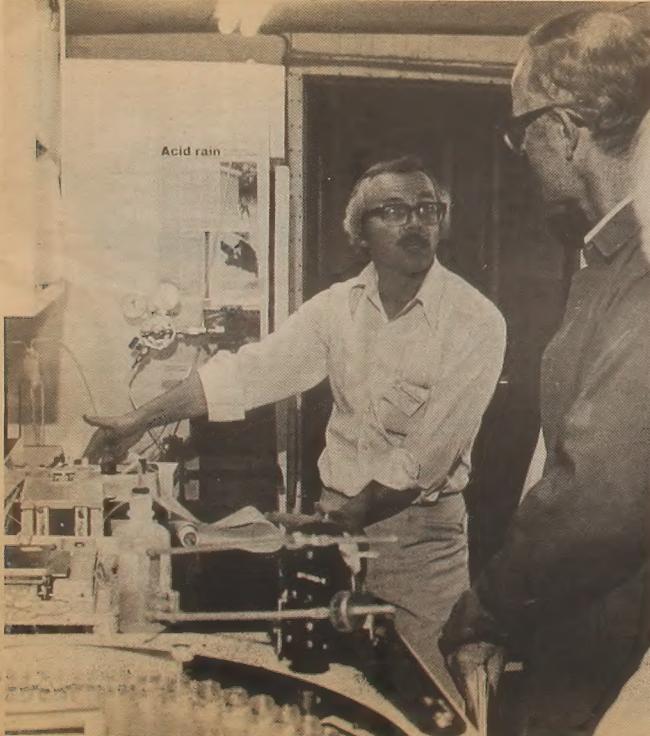
An Environment Ontario film on acid rain was shown continuously in a huge marquee tent, which also provided shelter from the sun and the intermittent rain squalls.

There was a brisk demand for literature describing various aspects of the problem.

Public reaction was totally positive. A common comment was: "It's nice to see the government spending money on something really useful."

The event was publicized well in advance by posters placed in shopping areas all over Muskoka and Haliburton, newspaper advertising, and public service announcements on a score of television and radio stations serving the area.

Coffee, doughnuts and lemonade were served by an organization of volunteers from Dorset. The supplies barely held out.





(Clockwise, starting upper right.)

Time passed quickly for visitors waiting in line to view the exhibits—Dr. Gregg Van Volkenburgh of the air resources branch listens attentively to an animated comment—Don Jelfs, water resources branch director, explains with humour—Dr. Tom Brydges, of the water resources branch, describes an automatic, moisture activated rain sampler—Serge Villard, of the laboratory branch, demonstrates some of the lab equipment on site—Dad is still very much interested, but junior would rather be somewhere else...

(photos: Hans Eijenck)





## 10,000 cattails will treat sewage

**Gay Frederick**, an Environment Ontario summer student, helps Harry C. Parrott, Minister of the Environment, plant cattails in Listowel. About 10,000 cattails were planted to form a marsh to treat sewage effluent from Listowel's lagoon system. The experimental marsh, the first of its kind in Ontario, may be a model alternative to expensive sewage treatment systems for some small communities in the Province.

(photo: Hans Eijenck)

## Peel sludge incinerator will save \$300,000 yearly

Construction has started on a \$37 million sludge incinerator designed to improve and increase the capacity of Environment Ontario's South Peel sewage treatment plant, and save about \$300,000 yearly in energy costs.

The new system, scheduled to be in operation by the end of 1980, will also eliminate odors normally associated with sludge treatment.

The South Peel sludge incinerator consists of equipment for the drying of sludge, of two incinerators, deodorizing equipment and buildings to house the facilities. The burning of sludge in

the incinerators will generate steam for the drying of sludge and for the heating of the plant. Additional energy will be saved by the elimination of the transport of sludge to land, on which it is now dispersed.

Currently, sludge is incinerated at sewage treatment plants in Toronto, Hamilton and London, Ont., but energy is not recovered in these processes.

The South Peel sewage treatment system serves about 400,000 people in the Regional Municipality of Peel and in the adjacent areas of Metropolitan Toronto. Installation of the incinerator will increase

the plant's sludge handling capacity to serve a population of 500,000.

The two sludge incinerators, valued together at \$5 million, are being manufactured at the Dorr-Oliver plant in Orillia and will be delivered to the site by end of 1980. The \$4.1 million sludge drying equipment has been purchased from Zimpro Inc. of U.S.A. and Komline Sanderson Ltd. of Brampton.

Construction of the building to house the sludge drying equipment and of concrete footings for the incinerator will cost another \$11.5 million.

## STP operators meet in Niagara Falls

"The Middle East and Alberta have oil, but Ontario has water, and that will, I believe, be the ultimate resource. After all, you can live without oil, but never without water," Environment Minister Harry C. Parrott told 250 Ontario water and sewage treatment plant operators and technicians at their annual conference in Niagara Falls.

If Ontario has become one of the leading jurisdictions in the world in both sewage and water treatment, this high standing is due in no small measure to the operators' knowledge and their industrious work, Dr. Parrott said.

During a question and answer period the operators revealed that their interest in the wellbeing of their communities went well beyond their regular job. Dr. Parrott answered questions on acid rain,

industrial waste and the financing of municipal pollution control projects.

Ontario's environmental problems were further outlined during the three-day convention by experts from the ministry and other involved organizations.

Dr. Gregg Van Vollenburgh and M.G. Thorne spoke about acid rain and the Mississauga chlorine spill. Ontario's water management policies and toxic substances were discussed by Steve Sabach and A.W. McLarty.

Technical questions on plant operations were the subject of the second day. They were answered in separate water and sewage treatment sessions. On the third day ministry and Civil Service Commission speakers dealt with administrative functions.

## Highway 89 project under full assessment

More than 60 submissions have been received by Environment Ontario Minister Harry C. Parrott following his call for public comment on the 50-kilometre extension of Highway 89 east of Highway 400 to Highway 12, proposed by the Ministry of Transportation.

The Minister also called for additional information from the Ministry of Transportation and Communications as part of the environmental assessment document required under Ontario's Environmental Assessment Act.

"Following review of the submissions received from residents, environmental groups and municipalities in the area and on the basis of the additional environmental assessment information provided by the Ministry of Transportation and Communications, I am prepared to accept their documentation," said Dr. Parrott.

The sponsors of briefs have until September 8, 1980 to indicate whether they wish to require a hearing before the Environmental Assessment Board. The Minister indicated that he is prepared to approve the initial phase of the proposal with conditions if no hearing is necessary.

Under Ontario's Environmental Assessment Act, significant provincial government projects must have a full environmental assessment. The proponent completes an environmental assessment of the proposal and submits the document to the Minister of the Environment. The Ministry acts as a co-ordinating body and calls for a review from Ontario agencies with an interest in a project.

The proposed 50 kilometre extension would use existing roads along much of the route with a new interchange at Highway 400, a new crossing over the Holland River and marsh area and a by-pass south of Uxbridge. Local municipalities have requested construction of the extension by the Ministry of Transportation and Communications.

A copy of transportation and

communications' environmental assessment, the Notice of Intent to require further information, the Notice of Completion of Review, the Government Review, and the public submissions including the two submissions from the proponent, may be reviewed during normal business hours at these locations:

Ministry of the Environment  
Environmental Approvals  
Branch  
10th Floor  
135 St. Clair Ave. West  
Toronto, Ontario  
M4V 1P5

Ministry of the Environment  
Central Region  
Suite 700  
150 Ferrand Drive  
Don Mills, Ontario  
M3C 3C3

Copies of the environment assessment and the review are also available for inspection at the following municipal offices: The County of Simcoe, Township of Innisfil, Township of West Gwillimbury, Regional Municipality of York, Town of East Gwillimbury, Township of Georgina, Regional Municipality of Durham, Township of Brock, and Township of Uxbridge.

### BONES RECYCLED.....

Animal bones, up to now generally considered to be a waste product of abattoirs, will be processed to yield proteins, minerals and fats in a new plant scheduled to start operation in September in England.

The plant will produce about 50 tons of usable products out of 100 tons of bone. Of these, about 25 tons of minerals will be added to health and baby foods. The fat can be added to bakery products and the protein will add nutritional value to foods like sausages and soups.

## Experience '80

# 250 students help on 70 projects

Students employed in the Experience '80 program provided intensive research and data on a number of environmental studies which otherwise could not have been accomplished, said Environment Minister Harry C. Parrott in describing the Ontario government's program just completing its eighth year.

The Experience '80 program is organized by Ontario's Youth Secretariat to provide employment

for students with appropriate skills and education.

Environment Ontario employed about 250 students on 70 projects throughout the province with a total budget just under \$400,000," said Dr. Parrott. "They earned the provincial minimum wage, \$3 an hour, for an average of 12 weeks. The wages weren't the main attraction. The students were drawn by the chance to get work experience related to their career plans."

For the ministry, it was an opportunity to put extra manpower into areas that require extensive research, or to get some preliminary data on a subject before starting a more elaborate study.

For example, at the University of Guelph, three senior economics students used ministry data on acidic precipitation in a statistical study that developed a framework for determining the economic impact of acid rain on sport fishing.

The method of cost/benefit evaluation will be used by the ministry for research into the economic impact of acid rain.

One project supervised by Dr. R. Drost and Dr. K. Adamowski at the University of Ottawa employed eight students to collect and analyze chemical and bacterial samples from Ottawa's Rideau River. Due to pollution caused by urban runoff and combined sanitary and storm sewer overflow,

three beaches along the river bank have been closed for swimming for eight years.

Ten students worked with the University of Toronto's Faculty of Forestry looking for evidence of termites in trees throughout the Metro Toronto area. Tree in high termite zones were checked for the soil tubings constructed by termite colonies, and in some cases trees were dissected to determine the extent of infestation.

## Termite hunters survey 50,000 city trees



Elga Jansons, Professor Paul Cooper and Dave Grant examine a piece of bark infested by termites.

(photo: Mary Ellen Lewis)

by Mary Ellen Lewis

"They seem to prefer Silver Maples and Horse Chestnuts, but don't bother with some others like Elms and Chinese Sumachs — maybe it's the taste of the wood," suggested Paul Cooper, professor at the University of Toronto's Faculty of Forestry. Mr. Cooper also co-ordinated an Experience '80 project in which ten students surveyed some 50,000 city trees for evidence of termites.

The termite-hunters, mostly forestry students, worked in teams of two to tally trees in parks and on boulevards, noting species, size, location, and assigning a general health rating based on foliage condition. Callipers were used to measure the diameter of the trunk. Visual inspection of the bark indicated the presence or absence of termite "tubings". Students also noted the number of tubings running up the side of the trunk.

Back at the office, each tree was recorded on a large map with colored dots indicating whether it was infested or termite free.

Eastern subterranean termites, the only type found in this part of the country, are commonly believed to only forage in the bark of trees, returning to inground nests

"We dissected some of the heavily infested trees which were planned for removal anyway, to find out whether they contained only the worker castes or whole colonies, evidence of the nests," said Mr. Cooper. "If we do find they're housing in the trees, it may mean that residents who have had their homes treated risk further infestation from nearby trees."

### each tree recorded

because they require moisture for their living-quarters. Professor Cooper believes that hollow trees, which can hold water, may house termite colonies too.

The survey concentrated on trees in areas where buildings have been treated for termites in the past ten years.

The project purpose was to find out whether termites infest only dead or decaying wood or if they also live in the sound hardwood and were therefore harming otherwise healthy trees. The data gathered on species, size and general condition of the trees will help experts make correlations.

"We've picked up some patterns. In parks, for example, the termites only tended to infest trees

around the periphery, not in the open, center areas," he said. "But we're not sure why."

Another finding of the study was that Carpenter Ants are most widespread, and may be a greater problem than termites. These ants chew clean patterns through the

"We were also doing a fumigation experiment with a new chemical in the lab for treating termite infested trees — to find out what concentrations and methods are most effective," said Dave Grant. "That was really interesting for me, because my final year thesis may be in that area."

Professor Cooper also studied different treatment methods used by the City of Toronto and private companies, by comparing three infested trees each treated differently, at Gerrard and River Streets. "We're looking closely at the results to see which treatment, either spraying the trunk or injecting the insecticide into the soil around the tree, or both, is most effective," he said. "The existing guidelines for termite treatment are vague and our data may help put more effective methods into practice."

### different treatments

wood, leaving small piles of sawdust outside the trees, as they prefer to keep "their house" neat.

Despite the summer heat and extensive footwork put in tallying thousands of trees over the 12-week project, forestry students Dave Grant and Elga Jansens both felt fortunate to have found course-related summer work.



Looking for litter is a serious business.

(photo: Hans Eijzenck)



#### *correct method of water sampling*

were used to measure pH and dissolved oxygen levels. The students learned the correct methods of water quality sampling and how these samples are evaluated in a laboratory.

The Experience program, now in its second year at the Pic #50 Band reserve, has rejuvenated an active awareness in the community towards environmental concerns. The students and their coordinator, Mrs. Fisher, are already mapping issues and ideas to tackle next year.

**After a long day in sun and dust comes the hour of reckoning.**  
(photo: Hans Eijzenck)

## *EXPERIENCE '80*

### **All's quiet on the Pic River**

by Joan Leishman

As you approach the reserve all seems quiet. Towering pines, sleek ashes and white birch frame the landscape. The Pic River pours soundlessly into Lake Superior. mauve and yellow wildflowers move gently with the breeze.

But further down the dirt road into the Heron Bay Indian Reserve, you meet the echos of hammers pounding new shingles into place, sounds of axes chopping dead branches and the snapping of freshly washed clothes drying in the wind.

There are other sounds too — the clinking of popcorns and the crackling of wrappers as children help out with Litter Day, organized

sued coupons according to the amount of litter gathered.

It was an exhausting day, but a rewarding one which left visible improvements. As a further reward, three films were shown that evening and coupons were exchanged for hotdogs and other refreshments.

Carol Desmoulin, one of the students who helped organize the campaign, was delighted with the results. "It was a success! — Not only because so many people helped and we collected 43 bags of litter, but also because everyone seemed to have a great time. I hope it will help everybody to remember to put litter where it belongs instead of throwing it around," she said.

Litter Day was only one of the projects the students were working on as part of their 10-week pollution control and community education program sponsored by Environment Ontario.

#### *big caches of empty cans*

by five Experience '80 students on the reserve, 250 miles east of Thunder Bay.

During the July 23 Litter Day, nearly 40 Ojibway children, aged from 2 to 14, slung garbage bags over their shoulders and dispersed over some of the reserve's 300 acres to collect waste.

Most of the children filled several bags — it was obvious that many knew where big caches of empty cans would be found.

At two counting stations the students calculated the number of cans and pieces of paper each participant brought in. They are

#### *burying old refrigerators*

Carol, along with Joanne and Vivian Michano, Roland Nabigan and John Starr, have been busy getting rid of debris on the reserve, helping to clean the water reservoir, and even burying old refrigerators and stoves littering the river bank.

The program is planned by the students and gives them a chance to be assertive and responsible by putting their ideas into action," said Cindy Fisher, project supervisor. "Pollution is a big problem, and it's good for the students to find ways of fighting it, and of passing their experience on to members of the community."

The students were also planning a nature hike for children between the ages of 8 and 14, and a writing and general drawing contest for younger members of the band.

Another event, organized by Bruce Foxton of Environment Ontario in Thunder Bay, was a water quality study of the community's reservoir. Portable kits

# EXPERIENCE '80



Students gather samples at the edge of a small creek.

## Sampling for vital data

by Patti Murby

Floating on a beautiful lake in the warm sun was work for two groups of Experience '80 students conducting water quality tests in Southeastern Ontario.

Students from the one group worked for a program originated by St. Lawrence College in Kingston. All study at the college during the school year in the Civil Technology and Resource Technology programs.

The water quality tests they take from Collin's Lake and Collin's Creek north of Kingston, were done both on and off shore. Sampling sounded easy but for the inexperienced it required patience and practice. Filling the sample jar to the precise height from a specified depth became an art for the students.

The samples were delivered to Environment Ontario's labs in Kingston and Toronto. The water was tested for such things as turbidity, BOD, metals and nutrients. The results from the tests and all information the students gathered were put into a report and used by the Ministry of Environment.

Crew Supervisor Julie McAlister, expressed her feelings about the program, "The money isn't very good but we all hope that the experience we get this summer will be worth much more than money in

the long run."

The second group of Experience '80 students travelled to 16 different sites to test water quality in the Southeast Region, visiting sites chosen because of specific problems. Work in each site included making a physical description of the area, charting stream characteristics, measuring flow and taking water samples.

The data this particular group collected could be vital information for planned new developments in the area.

Project supervisor, Barry Burns, explained, "Our ultimate goal for the use of the information the students gathered is to make an inventory of all surface water discharges in the region. With the data at our finger tips, we will be able to tell almost immediately whether a proposal for expansion in an area should be approved."

All the students involved in the water quality testing program are interested in environmental work and love the outdoors. Although they worked for minimum wage, the job related experience they gained from the program provided them with the opportunity to practice skills they learn in school and to gain insights into the type of career they may want to pursue.

## Sound meter readings reveal bad vibes

by Mary Ellen Lewis

A distant rumble heralded the approach of a long-awaited train. Civil engineering student Marcel Valieres adjusted his microphone and prepared to note the sound level metre reading. His partner, Peter Nash, watched closely as the cars rattled by and reported: "Two engines, six cars." These details were essential to the final testing of the system the two students had developed to measure vibration levels in this Experience '80 project coordinated by Environment Ontario's pollution control branch.

The pioneer study provided data on vibration levels and their effects on surrounding residents as a first step towards the development of guidelines to control groundborne vibrations. Parameters for noise control are established in many areas, but little is known about the effect of vibrations, which can weaken building foundations and may cause stress and related illnesses in nearby residents.

While the engineering students were measuring actual vibration levels, four other students developed a questionnaire to survey area residents. 19 sites had been chosen, all with 50 or more residences close to railway tracks, from Brampton to Pickering.

A number of methods for measuring vibrations were tested before the most accurate system was developed. Two methods combined to ensure accurate measurements were recorded: an accelerometer picked up vibrations through a microphone and con-

verted from decibels to meters per second squared through a sound level meter; while a vibration meter gave a velocity reading in meters per second. The delicate resonant frequency of the measure-

ments could be thrown off if the equipment isn't precisely adjusted.

The experience was invaluable to project leader Peter Nash, who graduated as an acoustics technician from George Brown College.

Peter hopes to work in transit research and engineering to reduce noise and vibration levels in subways and in vehicles.

"I'm very concerned about the effects these levels may have on

people," said Peter. "It's an unexplored area and we could turn up some interesting results, especially if the survey responses correspond to levels of vibrations actually occurring."



Marcel Valieres and Peter Nash set up equipment to measure vibrations from railway tracks.

(photo: Tessa Bachan)

## Experience '80

# 1500 cottages inspected

by Ken Ballantyne

Eight students, taking courses ranging from natural and resource sciences to engineering physics, took part in Environment Ontario's Cottage Pollution Control Program and inspected the sewage systems of some 1,500 cottages in Central Ontario this summer.

Employed through the Experience '80 program, the students worked in pairs to interview cottagers, sketch properties, inspect pipes, check the location of septic tanks and look for faults in the system. After inspection they also rated the septic system for quality and an initial letter was sent from the ministry to the owner with recommendation of necessary changes.

The project's main objective was to ensure that cottagers are disposing of their sewage in an environmentally safe way. If unsafe disposal is found, either the local health unit or the Ministry of Environment ensures that the situation is corrected.

Four students lived in a cabin on the North Shore of Sturgeon Lake and boated their way to about 700 cottages in their effort to keep Ontario lakes as pure as possible. This group was supervised by Joe Olajos, a ministry private abatement officer who has been with the program since it started.

In the Muskoka-Haliburton region, two pairs of students set out

in boats and interviewed about 850 cottagers. These students inspected systems on Lakes Kashagawigamog and Soyers in the Haliburton region, and Stewart Lake, Black Lake and Lake Muskoka.

The Cottage Pollution Control Program began in 1970 on the major Kawartha Lakes and the Trent Canal. According to Terry Healy, ministry abatement officer, it was not uncommon to find people dumping raw sewage into the water at that time.

Today this problem rarely occurs. Most of the problems found by the students are corrected.

"Only about 2 per cent of the cottagers refuse to let us on the property," said Healy, who was also supervisor of the students in the Muskoka-Haliburton region. "The cottagers really seemed to be concerned about the environment and are most cooperative."

About 40 per cent of the cottages surveyed required some correction to their system.

"Cottage Country," an environmental guide to cottagers, was distributed to cottagers when their property was surveyed.

Copies of this guide are also now available from Environment Ontario's Muskoka-Haliburton district office in Gravenhurst and the Peterborough district office.



Experience '80 students, Tammy Lomas and Kevin Onclin were employed in the cottage pollution

(photo: Ken Ballantyne)



Kevin Barber nets minuscule insects collected in a pan trap at a site near Guelph University.

## Putting labels on bumble bees

by Joan Leishman

Some people call them Insecta, Hymenoptera, Apidae, Bombus affinis. But most of us simply refer to them as bumble bees.

Labelling insects by class, order, family, genus and species was one of the functions nine Experience '80 students at the University of Guelph were working on this summer.

During the 12-week program sponsored by Environment Ontario, five of the biology students collected insect fauna throughout the province, dried the specimens, and mounted them.

### *...top level bank of specimen...*

The insects were then categorized by class, order and family, and in some cases more specifically by genus and species.

This type of project is vital to the university so we can maintain a top level bank of specimens for both teaching and studying," said Kevin Barber, who acted as resource person for the study.

Mr. Barber, along with Joanne Cashaback, Susan Beierl, Donna Kralo and Kathy Harvey, visited 13 collection sites in Southern Ontario including Point Pelee National Park, Ipperwash Provincial Park and Dundas Trails.

Various methods were used during collection to ensure a good variety. Netting was an old time favourite, but other instruments, less labour intensive, were sometimes preferable.

Brightly painted pans holding saturated salt water, formaldehyde and soap (to break the surface tension), attracted and trapped insects without the students help. The malaise, a tent-like structure illuminated by a fluorescent light, was also used.

Bugs which roost beneath logs and grasses by day were attracted by ultra violet lights, reflecting from a white sheet at night.

The determination of what insects can be found in what area, depending on soil types, climate, vegetation, humidity, altitude and the hosts inhabiting the area, was another task of the group.

The extensive use of herbicides and pesticides made this part of the study somewhat incongruent.

"When these chemicals are applied, the insects either adjust or die. If they adjust, the mutations become evident quite quickly because of their short life cycle," said Joanne Cashaback, a major in animal science.

Some insects produce two or three generations in a single summer and a slight mutation spirals almost immediately, she said.

"Chemicals are defeating the purpose," Ms. Cashaback said. "the population can and will control itself if we stop interfering."

But even among the students there was no consensus on the issue of chemicals to control the population.

"Our variable climate is not conducive to biological control," said Karen Bailey, an Experience student working in plant pathology. "It's a controversial subject and we have to study the circumstances and the consequences, lifecycles and breakdown patterns carefully before chemicals are used."

### *...diseases of cereal crops...*

Ms. Bailey is collecting and studying diseased plants to determine the kinds of diseases affecting cereal crops. "We can't eliminate agriculture, so we have to find ways of getting rid of the pests which hamper it."

Other students working on the Experience program were assisting Ph.D. students in sorting aquatic insects from stream beds, collecting weed specimens for teaching, and studying sphaleroceridae — dung flies to most of us.

(photo: Joan Leishman)